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COMMITTEE ON THE PEACEFUL USES OF
OUTER SPACE

INTERNATIONAL CO-OPERATION IN THE PEACEFUL USES OF OUTER SPACE - PROGRAMMES OF MEMBER STATES

Note by the Secretariat

In accordance with General Assembly resolution 43/56 of 6 December 1988, the Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space, at its 1989 session, re-established the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82). The report of the Working Group of the Whole on the work of its third session (A/AC.105/429, annex II), which was adopted by the Scientific and Technical Sub-Committee at its twenty-sixth session, contained recommendations which were endorsed by the Committee on the Peaceful Uses of Outer Space in its report, 1/ which was subsequently endorsed by the General Assembly in its resolution 44/46 of 8 December 1989.

Among the recommendations, the Working Group of the Whole proposed that the Committee renew its request to all States, particularly those with major space capabilities, to inform the Secretary-General concerning those space activities which could be the subject of greater international co-operation, in order to permit a better assessment of the future of such international co-operation by the Working Group at its next session (A/AC.105/429, annex II, paras. 4 and 4 (c)). The Working Group also recommended that the Committee invite Member States to report annually on techniques resulting from medical studies carried out in outer space (A/AC.105/429, annex II, paras. 5 and 5 (a)).

The Secretary-General subsequently addressed a note verbale dated 30 June 1989 to all Member States, requesting them to communicate to the Secretariat, by 1 December 1989, the information requested in the above-mentioned recommendations. The substantive responses received up to 15 January 1990 from six Member States (Czechoslovakia, Finland, the Netherlands, Pakistan, Sweden and the Ukrainian Soviet Socialist Republic) are reproduced below.

CZECHOSLOVAKIA

[Original: English

In respect of paragraph 4 of A/AC.105/429, annex II, Czechoslovakia is not among the countries possessing their own space potential and, therefore, cannot offer activities that could become the subject of broader international co-operation.

Czechoslovakia carries out its space activities through its participation in the Interkosmos programme. A summary report on the activities carried out jointly by countries which are members of the Interkosmos programme in the period 1988-198 has been prepared by the Union of Soviet Socialist Republics, which will submit it for information at the 1990 session of the Committee on the Peaceful Uses of Outer Space.

In respect of paragraph 5 of the same document, requesting information on medical techniques, Czechoslovakia used the following medical equipment in 1988-1989 for space experiments.

To investigate the influence of space flight factors on man's metabolic functions, a Plasma-02 Set has been developed in Czechoslovakia (Institute for Experimental Endocrinology of the Slovak Academy of Sciences) for the withdrawal, separation and preservation of body fluids of astronauts on board the Mir orbital station. This set was used, inter alia, during the joint Soviet-French space flight (the ARAGATZ Project). An analysis of the samples of blood withdrawn showe a significant rise in noradrenalin on the ninth day of the space flight. Professor L. Macho and collaborators (Czechoslovakia) pointed out changes in the level of hormones, particularly corticosteroids, tyrosine and catecholamines, afte a space flight. Of particular significance was the rise in the level of insulin observed in the astronauts' bodies in the early post-flight stage, after short as well as protracted flights. The scientific knowledge gained was presented by Czechoslovak scientists at the eighth International Symposium on Man in Space, in 1989, and at the fortieth Congress of the International Astronomical Federation, also in 1989.

Another Czechoslovak medical instrument used directly in space conditions is an oximeter designed to determine oxygen tension in the tissue of live organisms (Institute of Biophysics, Czechoslovak Academy of Sciences). There are two versions of the apparatus in existence: one is used for manned space flights and the other in bio-satellites with small laboratory animals on board. In Czechoslovakia, the space oximeter became the basis for the commercially produced clinical version.

To examine the process of thermoregulation in an astronaut's body during changing air circulation conditions in microgravitation, an electrodynamic cata-thermometer has been developed in Czechoslovakia (Faculty of Medicine, J. E. Purkyně University); the device is a part of the equipment of the Mir orbital station. There is another version of the apparatus used in bio-satellites to regulate micro-climate parameters in the capsule containing animals.

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Professor L. Novák reported on the results of this technique at the eighth International Symposium on Man in Space, in 1989.

Further medical equipment is currently being developed in Czechoslovakia; this includes a vestibulostimulator, a pneumotachograph and a plathysomanometer. The equipment will be used on board orbital stations.

FINLAND

[Original: English]

Finland's space activities and related projects are carried out either as small-scale undertakings at the national level or as a part of large-scale international co-operative projects. As far as the former are concerned, greater international co-operation is not envisaged. As regards the latter, Finland participates in international space co-operation through its associate membership of the European Space Agency (ESA) as well as its participation in the Soviet space programme. In both cases, any expansion of co-operation beyond present levels is subject to mutual consultations and agreement.

Finland does not carry out any medical studies in outer space.

NETHERLANDS

[Original: English]

Co-ordination of the activities related to space science is the responsibility of Space Research Organization Netherlands (SRON). Several institutes have a programme in which some kind of space-related research is carried out. No medical experiments in outer space have been conducted in the last two years. Space science-related medical studies were conducted at three institutes in the Netherlands and their results can be summarized as follows.

A. Neurophysiology Institute, Soeterberg, the Netherlands (W. Bles)

Vestibular physiology is the main theme.

1. Higher g-load effects were studied in former ESA astronauts with a view to gaining greater insight into the mechanism of space sickness. This project was carried out in close co-operation with Delft University of Technology (Aviation Department) and the University of Amsterdam (Medical Faculty, Ear, Nose and Throat (ENT) Department).

Results

A hypothesis was formulated about the genesis and development of space sickness.

2. Eye movements following vestibular tests were studied during parabolic flight. Results are not available as the study has not yet been completed.

B. University of Amsterdam, Medical Faculty, Department of Internal Medicine (J. M. Karemaker, W. Wieling)

Blood pressure measurements

Blood pressure was measured with a recently developed device, the fine press, which is able to obtain information from a subject's finger.

Results

During parabolic flight blood pressure changes were measured in human subjects. (Parabolic flight experiments were conducted in ESA's parabolic flight campaign at Bretigny, France.)

C. Department of Otorhinolaryngology (Prof. W. J. Oosterveld, H. A. A. de Jong, H. W. Kortschot). Section: vestibular system

Three experiments were conducted in ESA's parabolic flight campaign at Bretigny, France, making use of the Caravelle 234.

1. Vestibular tests during weightlessness

The mechanism of the caloric test, which is clinically of great importance, is not clear. The test was performed during weightlessness in human subjects in parabolic flight.

Results

The results provided an improved theory which explains its mechanism. The results have led to the development of a better method for determining the function of one separate labyrinth in humans. This improved method is now clinically used.

2. Pupil size measurements during weightlessness

Studies in animals have shown that in some species neurological pathways exist between the balance organs and the ocular muscles which serve pupil dilatation and constriction. The meaning of this structure is not known. Pupil size was measured

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both during weightlessness in parabolic flight and during higher g-load experiments in a human centrifuge.

Results

The experiments have proved that in humans "vestibular ocular" pathways exist which connect the nucleus of Edinger Westphal with the vestibular nuclei. With these results the close relationship between vision and vestibular symptoms such as vertigo and dizziness can be explained.

3. Cervical column movements

Movements of the cervical column are able to induce vertigo in man. This is assumed to be caused either by signals from pressure-detecting devices in the cervical muscles or by gravity effects on the cervical vertebrae. An experiment was carried out with human test subjects who had to make head movements in the weightless periods in parabolic flight.

Results

Head movements in humans were studied in parabolic flight. Pressure devices in the cervical muscles proved to be the main source for collecting signals during head movements. For clinical practice this means that a test method in which head movements are the stimulating component provides insight into the condition of cervical muscular structures.

PAKISTAN

[Original: English]

Paragraph 4 (c)

It is quite obvious that space technology is very expensive and demanding in its requirements and the majority of the developing countries cannot undertake each and every aspect of it on their own. It is therefore essential that greater international co-operation be brought about in the following space related activities:

(a) Sharing of experience by the technologically developed countries with the developing countries in various fields relating to space technology and space sciences (for example, design and development of low-cost satellite systems for communication; remote sensing and meteorological applications; development of satellite launching capability; design of hardware for scientific experiments on board a spacecraft, etc.);

(b) Provision of launch services, at reduced rates, by the developed countries for the satellites developed by the developing countries;

(c) Placement of scientists/engineers of the developing countries in the establishments located in the developed countries engaged in space technology-related activities, for their acquisition of "hands-on" experience;

(d) Accommodating in the spacecraft operated by the developed countries of scientific experiments designed by the developing countries involved in space research activities;

(e) Wide dissemination of scientific/technical information relating to the spin-off benefits emanating from the activities of the space-faring nations in outer space and assisting developing countries in their useful applications.

Pakistan has already announced the training opportunities for the scientists/engineers of the developing countries in the following fields:

(a) Ionospheric studies;

(b) Remote sensing applications to Earth resources survey;

(c) Design and development of ground terminals for the reception of signals from direct broadcast satellites.

These opportunities have been circulated in documents A/AC.105/366 and Add.1 and A/AC.105/432.

Paragraph 5 (a)

At present, the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), the national space agency, is not engaged in medical studies carried out in outer space. However, it maintains a deep interest in developments in this field and would like the developed countries making progress in this area to share their experiences with the developing countries.

SWEDEN

[Original: English]

I. RECOMMENDATIONS OF THE SECOND UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

UNISPACE 82 made a number of recommendations aimed at strengthening international co-operation regarding outer space. Sweden has repeatedly called for a more rapid implementation of those recommendations.

The Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space has recommended that the Outer Space Affairs Division prepare a report for the next session of the Sub-Committee, indicating which of the recommendations addressed to the United Nations have not yet been implemented. Sweden believes that such a report will provide a valuable basis for the further consideration of this subject by the Sub-Committee.

The recommendation to strengthen the United Nations Space Applications Programme was one of the most important achievements of UNISPACE 82. The Programme is a central instrument in fulfilling the philosophy behind UNISPACE 82.

One area which Sweden considers particularly suitable for greater international co-operation is remote sensing.

In support of the activities of the Space Applications Programme in this field, Sweden will in 1990 host a United Nations training course. The course will be held for the benefit of States members of the United Nations Economic Commission for Africa (ECA) region and will be organized as a teacher's education programme.

The main object of the course is to develop the practical knowledge and skills of university educators from developing countries in remote sensing technology, as well as to equip them with an ability to introduce elements of the technology, as may be appropriate, into the higher education curricula in their own countries.

The programme will be arranged under the auspices and sponsorship of BITS, the Swedish Agency for International Technical and Economic Co-operation, and organized by Stockholm University in co-operation with the Royal Institute of Technology (KTH) and the Swedish Space Corporation, Stockholm.

II. PROBLEM OF SPACE DEBRIS

Space technology applications and research can constitute important factors in the peaceful development of the world. For certain regions, space techniques are the most practical solutions to improve, e.g., communications, education, mapping and inventory of natural resources.

Space should be accessible to all countries. Pollution of the space environment and the increasing risks of collisions between space debris and spacecraft reduce the accessibility of space for all countries. Should collisions occur with spacecraft carrying nuclear power sources, the consequences could be very far-reaching.

Over the last few years, space debris have come to be identified as a serious threat to man's exploration and utilization of outer space. This has been indicated in various studies conducted at both the national and the international level.

The dimensions of the problem of space debris are such that they require the immediate attention and active involvement of the international community. The 1967 Treaty on outer space lays down that the exploration and use of outer space shall be the province of all mankind. The common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes is equally well established. Therefore, all States should identify ways and means of addressing the problem of space debris, also keeping in mind the interest of future generations.

Increased knowledge regarding the space environment is necessary to control the amount of space debris. Compilation of, and access to, data on space debris and the tracking and monitoring of the space debris environment cannot be done effectively without international co-operation.

Sweden has not so far undertaken any national studies on space debris. The efforts in this field are channelled into the international forums in which Sweden participates.

Sweden actively supported a resolution on the issue of space debris, which was adopted in June 1989 by ESA and which aims at increasing the knowledge of the problem, reducing the production of space debris and promoting the exchange of information and co-operation with other space operators.

Sweden has also raised this issue in the United Nations on several occasions, both with respect to the seriousness of the problem and with respect to our belief in the role that the United Nations has to play in matters of global interest.

At the 1989 session of the Committee on the Peaceful Uses of Outer Space, Sweden, together with Australia, Belgium, Canada, the Federal Republic of Germany, the Netherlands and Nigeria, presented a working paper, in which it was proposed that the issue of space debris be put on the agenda of the Scientific and Technical Sub-Committee at its next session.

UKRAINIAN SOVIET SOCIALIST REPUBLIC

[Original: Russian]

Information on national and international space research during 1988

Space research in the Ukrainian SSR during 1988 addressed issues such as aircraft mechanics, astrodynamics, spacecraft navigation and manoeuvring and instrument manufacture.

The Republic believes that improving space engineering, technology and research methods increases opportunities to use spacecraft for basic research on the universe at different wavelengths and investigations of near space and solar-terrestrial interactions. Applications of space technology are also becoming ever more important in studying natural resources and environmental conditions and dealing with the overall problems of economic development in different parts of the country. A feature of recent years has been the explosive development of space-based remote-sensing techniques. Ukrainian scientists last year worked on elucidating the theoretical principles of this discipline and developing methods and equipment for making observations and transmitting and processing the information obtained. The Republic's "Ukrkosmoresursy" programme was developed and adopted with a view to better co-ordinated work in this sphere.

A method has been devised for the routine sensing of tropical cyclones (hurricanes, typhoons), and for determining the energy characterisics of and planar wind-speed distribution within such formations in all weathers. It may be used in international co-operation, to notify interested countries of the positions and parameters of hurricanes and typhoons. Detailed calculations were made of statistical variability in the spectral luminosity of the ocean-atmosphere system in the visible range. A data bank on ocean radiation levels was compiled from satellite data. Monthly climatic charts were drawn up to reflect three sets of values for the ocean radiation balance: at the upper limit of the atmosphere, at ocean surface and throughout the atmospheric layer.

A physical model for the transfer of radiation through the plane-parallel atmosphere was devised for use in the remote sensing of oceans. As part of a direct assignment, software for calculating the radiation budget of the ocean-atmosphere system was developed.

Examples of dynamic processes and phenomena were analysed for the general case on the basis of satellite data for various regions. Materials were assembled for trying out a handbook on the analysis of oceanic phenomena and processes based on satellite data and low-level observations.

Programmes were compiled for the thematic processing of Trasser ("flare") equipment data, and trial areas for measurements with that equipment from the Okean satellite were prepared. A preliminary conclusion was drawn as to its information potential. The processing of information from the Okean satellite continues.

Work on natural resources sensing programmes continued in 1988. The basic principles for the construction of a multi-purpose data-bank utility were established and basic software and programmes for interpreting remote-sensing data with a view to the rational exploitation of natural resources were created.

In the process, it was found possible to set up not only a command-system utility but also a utility for preliminary thematic image processing, thus making it significantly easier for the user to take decisions when investigating the properties and status of environmental systems.

Individual elements of a regional geo-information system for the environmental monitoring of the western part of the Republic were developed and officially approved. A method for the mathematical/cartographic modelling of natural socio-environmental systems was developed for use in the overall evaluation and formulation of scientifically sound recommendations on natural resources research and the monitoring of exogenous geodynamic processes.

A broad range of basic research was carried out at the Ukrainian Academy of Sciences and other government institutions with a view to the creation of new examples of space engineering, testing different technologies and studying the medical and biological aspects of prolonged stays by crew members on board orbital space stations. The physics of metallic monocrystal growth in zero gravity, low-temperature phenomena in materials for space engineering, the effects of radiation on metals, the physics of metallic surfaces, sub-surface layers and

coatings in space engineering, new specialized methods of research into the physical behaviour of metals in space and high-temperature deformation and destruction mechanisms in materials for space engineering were studied.

The physical principles, technology and laboratory equipment for the creation, under conditions including those of outer space, of eutectic materials with a unidirectional composite structure offering increased durability over a broad range of temperatures were developed in 1988. The foundations were laid of a technology for the application of eutectic coatings, making it possible to prolong the lifetime of wearing parts in space engineering, to replace hard-to-get and expensive materials and to dispense with chemical heat treatment. New materials and technological principles were also proposed for the application of wear- and corrosion-resistant coatings to cold substrates.

Work continued on assembly and repair techniques and equipment for special-purpose large-scale structures. Highly efficient, reliable, compact power supplies were developed for technological installations and girder-assembly units. Specimen electron-beam welding tools were produced.

The technology of waveguide manufacture with different types of antenna was developed. Vibration tests on antennas manufactured using that technology enabled efficient parameters to be selected for the support structures used to mount antennas on spacecraft. A physical and a mathematical model were constructed of the external atmosphere that forms around irregularly-shaped vehicles moving through the upper layers of the Earth's atmosphere.

Multi-purpose radiophysical research continued into the large-scale and global disturbances caused by local releases of seismic, seismo-acoustic, chemical and electromagnetic energy. The objective of these activities is to investigate links between the atmosphere, the magnetosphere and the ionosphere and to construct a model of the various phenomena concerned. A method of measuring the brightness of low-orbiting man-made objects by comparison with stars observed moving along their paths was devised. Work proceeded with a view to ensuring the radiation safety of space flights.

Work was undertaken on the medical and biological problems arising in the course of prolonged use of manned orbital stations. The main topic addressed in the course of the space biology programme is the biology of plant cells under space-flight conditions and the mechanisms of cellular adaptation to such conditions.

Steps were taken in 1988 to improve the technology by means of which vegetables, vitamin-rich and other plants are cultivated in soil substitutes using multi-purpose fertilizers and to develop methods of enhancing the resilience of vitamin-rich vegetables and plants when grown in a closed system.

One important feature of the atmosphere in closed life support systems is the interaction between higher plants and volatile human omissions. Experiments were conducted to develop methods of enhancing the resilience of vitamin-rich vegetables and plants when grown in a closed system.

The Ukrainian Academy of Sciences Scientific Council on the Investigation of Natural Resources by means of Space Technology took part in the preparations for Tianshan-Interkosmos 88 air and space experiment and the experiment itself. Scientists from eight countries (the Soviet Union, Bulgaria, Hungary, Viet Nam, the German Democratic Republic, Poland, Romania and Czechoslovakia) took part. Satellite, aircraft and ground observations in the visible, infra-red and UHF frequency ranges were used to study the characteristics of contemporary geodynamic processes in the area where the Pamir and southern Tianshan ranges meet, and how those processes are reflected in the geochemical (presence of different trace elements in bodies of water, soil and plants) and geophysical (magnetic, gravitational and thermal) fields.

In accordance with the programme of the socialist countries' working group on remote sensing, experts from Hungary, the German Democratic Republic, Poland and the Soviet Union met at Yalta from 24 to 29 October 1988 to discuss methodology and equipment for sub-satellite experiments on the surface of the sea.

Experts from Bulgaria, the German Democratic Republic, Poland, Romania, the Soviet Union and Czechoslovakia, meeting in L'vov from 17 to 22 October 1988, considered the results of packaging the scientific equipment on a module of the Mir space station on the basis of proposals made by the countries concerned.

Notes

1/ Official Records of the General Assembly, Forty-fourth Session, Supplement No. 20 (A/44/20).

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INTERNATIONAL CO-OPERATION IN THE PEACEFUL USES OF OUTER SPACE - PROGRAMMES OF MEMBER STATES

Note by the Secretariat

Addendum

The present document contains information provided in replies received from Member States relating to paragraphs 4, 4 (c), 5 and 5 (a) of the recommendations of the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) (A/AC.105/429, annex II) up to 5 February 1990.

CONTENTS

	Page
Australia	2
Japan	6

AUSTRALIA

[Original: English]

Australia has a significant involvement in the civilian space area through its activities in communications, remote sensing, space science and space industry.

Australia's population, land mass and dependence on natural resources and agriculture render satellite technology perhaps more useful than any other country and has led to an advanced capability in applications development.

Australia relies on communications satellites; meteorological satellites; earth-sensing satellites; navigation and geodesy satellites; and search and rescue satellite systems.

The major participants of space activities in Australia are the Australian Space Office (ASO); AUSSAT Pty Ltd; OTC (Overseas Telecommunication Corporation) Limited; ACRES (The Australian Centre for Remote Sensing); COSSA (Office of Space Science and Applications of the Commonwealth Scientific and Industrial Research Organization (CSIRO)); and the Bureau of Meteorology. A brief outline of the current involvement in space-related activities for each of these organizations as well as in the areas of education and training and space life sciences is set out below.

Australian Space Office

ASO is the national body responsible for space policy and space industry development. It has the responsibility for co-ordination of space activities carried out in Australia. It manages the National Space Programme aimed at funding activities which will improve the competitive position of Australian firms to supply space-related goods and services as well as support for national space projects.

ASO provides administrative and secretariat support to the operations of the Australian Space Board, which advises the Government on space policy and industry development priorities. It also implements agreements for the support of foreign civilian space programmes, particularly for the National Aeronautics and Space Administration (NASA) of the United States of America and the European Space Agency (ESA). The principal activity under these arrangements is the management and operation of the NASA Deep Space Communications Complex at Tidbinbilla, near Canberra.

AUSSAT Pty Ltd

AUSSAT is a company wholly owned by the Australian Government with the intention of providing a commercial, satellite-based communications system within both Australia and New Zealand. AUSSAT currently operates three satellites. The first two (A1 and A2) were launched in 1985 on the United States Space Shuttle while the third (A3) was launched in 1987 on the European Ariane rocket. AUSSAT is

currently procuring two second-generation spacecraft and these should enter service in late 1991 and mid-1992.

The second-generation satellites (B1, B2) will eventually replace A1 and A2 and will offer extended capability, particularly in the mobile satellite services area in the L-band. Contracts are in place to launch the B1 and B2 spacecraft on the Chinese Long March 2E rocket in 1991 and 1992 respectively. Following an extensive international tendering process, both first- and second-generation spacecraft are being manufactured by the Hughes Aircraft Company in California.

Existing or potential areas for additional AUSSAT involvement in international space-related co-operative activities are as follows:

(a) Mobile satellite services: AUSSAT is currently in discussions with relevant organizations in the United States, Canada and Europe with a view to establishing operational standards for this service. Australia will probably have the first such service in the world. AUSSAT also has agreements with Japan to use the ETS-5 satellite for test transmissions of the mobile service prior to the introduction of B1/B2;

(b) Launch support: AUSSAT currently has a number of contracts with overseas organizations to provide ground station support for the launch and early orbit operations phase of their spacecraft. For example, the BSB (United Kingdom of Great Britain and Northern Ireland), JCSAT (Japan), Superbird (Japan) and early Anik (Canada) satellites have been, or will be, supported by AUSSAT in this way;

(c) AUSSAT representatives are members of a variety of international technical committees including the International Telecommunication Union (ITU) and the Space Advisory Board of British Satellite Broadcasting (BSB);

(d) AUSSAT is one of the most experienced commercial satellite operators outside the United States. Virtually all staff are now trained in-house in their specialized areas. Such training could be made available to overseas organizations that are establishing their own satellite capability;

(e) AUSSAT manages all its own space and ground segment procurements. Therefore they are well placed to assist any organization in areas such as:

(i) Technical consultancy;

(ii) Risk management advice;

(iii) Conceptual design and specification of satellite systems (space/ground);

(iv) Tendering, contract negotiations and procurement assistance;

(v) Contract monitoring and support at any stage, including design reviews and unit, subsystem and system level testing.

OTC Limited

OTC acquires space segment capacity through its signatory relationship with the International Telecommunications Satellite Organization (INTELSAT). OTC is actively involved in INTELSAT fora and tries to facilitate Australian industry participation in INTELSAT's research and development activities. OTC's other major investment is in the Earth segment which, although subject to international co-operation in that certain Earth station standards must be met globally, is not "space-related".

ACRES

The Australian Centre for Remote Sensing, Australian Surveying and Land Information Group, is involved in space-related activities, the reception, archiving and distribution of Earth resources satellite data, but these activities are not subject to international co-operation. ACRES activities are regulated by formal agreements negotiated with the individual satellite operators, who charge for the use of their satellite(s).

On occasions, for very short periods, the reception antenna at Alice Springs is used as part of a national or international network for space-related information gathering. Such co-operation, however, forms only a very minor part of their main remote sensing activity.

COSSA

COSSA identifies space-related technologies and applications arising from CSIRO's existing scientific programmes. It co-ordinates and, where appropriate, manages these activities in order to support and develop Australian industries that use or provide space-related products and services. COSSA also promotes Australian participation in international space-related activities and tries to increase awareness of the opportunities such participation presents for exporting space-related products and services.

In the communications field, CSIRO assisted OTC in designing telecommunications satellite Earth station antennae established in Malta and in Ho Chi Minh City and Hanoi. The installation in Ho Chi Minh City resulted in a ten-fold increase in telephone traffic between Australia and Viet Nam in the first year.

In the science area, CSIRO co-operated with the NASA Deep Space Network in the August 1989 encounter of Voyager 2 with Neptune using the Parkes 64-m Radiotelescope which is now part of the Australia National Telescope Facility.

CSIRO and the National Space Development Agency of Japan (NASDA) collaborated on the reception of data from MOS-1 (Marine Observation Satellite). Data received in Australia were distributed to several scientific investigators, and a greater volume will be available in the near future. NASDA and CSIRO are currently negotiating agreements for the extension of reception and for the distribution of data to third parties.

The new Director of the CSIRO Office of Space Science and Applications (COSSA), Dr. Graham Harris, was nominated as the only Australian Principal Investigator for NASA's Earth Observation System investigations of the coming decade.

CSIRO continues the testing and development of airborne remote sensing instruments for oceanographic, mineralogical and atmospheric applications. The CSIRO tunable carbon dioxide lidar, Ericsson X-band Sideways Looking Airborne Radar (SLAR), the Atmospheric Pressure Scanner (APS), and the CSIRO Department of Science and Technology (DST) Ocean Colour Scanner were all flown successfully during 1989 on the CSIRO Research Aircraft. The instruments and data systems will be further developed during 1990. It is hoped that APS will form the basis for a satellite-borne instrument for global surface pressure measurements during the second half of the 1990s.

Bureau of Meteorology

The key space-related activities in the Bureau of Meteorology which are, or could be, subject to international co-operation are:

(a) Continuous operational reception of observational data from instruments on the National Oceanic and Atmospheric Administration (NOAA) Meteor and geostationary meteorological satellites;

(b) Reception of data from experimental satellites such as the Chinese FY-1 meteorological satellite;

(c) Processing of geophysical data from meteorological satellites, for example, the production of the Television Infrared Observation Satellite Operational Vertical Sounder based soundings, cloud drift winds and sea surface temperature;

(d) The study and operational practice of assimilation of these remotely sensed data in numerical analysis and prognosis schemes;

(e) Co-operation in the development of new instruments, e.g., the Polar Platforms (NPOP-1) via team membership in the Advanced Infrared Sounder (AIRS) Science Team and participation in an interdisciplinary study of the impact of a variety of satellite-sensed data;

(f) The design and deployment of automatic weather stations which are interrogated from space, and the subsequent processing of that data.

Education and Training

In education and training, the Australian Government, through the Australian International Development Assistance Bureau (AIDAB), supported the attendance of two Australian experts, Mr. George Whitehouse and Mr. Peter Woodgate, at an Economic and Social Commission for Asia and the Pacific (ESCAP) workshop on the applications of remote sensing to flood plain management at Dacca in December 1989. AIDAB also supported the fifth United Nations/Food and Agriculture

Organization of the United Nations (FAO)/World Meteorological Organization (WMO)/ESA Training Course on the Use of Remote Sensor Systems in Agrometeorological and Hydrological Applications (see A/AC.105/437), organized in co-operation with ESCAP and held at Canberra from 15 May to 2 June 1989, and the first International MircoBRIAN course, held at Brisbane in June 1989. The courses were arranged for AIDAB by CSIRO.

Space Life Sciences

Influenza crystal growth experiments were conducted on the Mir space station of the Union of Soviet Socialist Republics by Dr. Graeme Laver of the Australian National University, with the assistance of the Department of Industry Technology and Commerce (Australia) and GLAVCOSMOS of the USSR. The experiment is aimed at the elucidation of the structure of the influenza virus, in order to design effective drugs to counter the effect of the disorder. The results of the flight are still being determined. A similar experiment was to take place on the United States Space Shuttle in December 1989.

JAPAN

[Original: English]

1. Present activities

(a) Geostationary Meteorological Satellite

The Japanese Geostationary Meteorological Satellite (GMS) has played an important role in the Global Observing System of the WMO World Weather Watch (WWW) in conjunction with geosynchronous meteorological satellites launched by the United States, Europe and India as well as polar orbital meteorological satellites operated by the United States and the USSR.

GMS has provided meteorological service for over 20 countries/areas in Asia and Oceania. The images received are fully utilized for various meteorological information services. Furthermore, GMS is serving to improve meteorological telecommunications by collecting the observation data from ship and remote areas/islands.

GMS-4 was launched in September 1989, as the successor to the GMS-3.

(b) Marine Observation Satellite-1 (MOS-1)

MOS-1, Japan's first remote-sensing satellite, was launched in February 1987, and its orbit is sun-synchronous at an altitude of approximately 900 km. The satellite's specific objectives are to observe marine phenomena such as the change in colour and temperature on the ocean surface and to establish a common technology for Earth observation satellites. Its image data are directly received by Thailand, Australia, Canada and ESA.

(c) X-ray astronomy satellite

The X-ray astronomy satellite "Ginga" was launched in February 1987. Shortly after its launch, the satellite, for the first time anywhere in the world, detected the X-ray from the supernova SN1987A which appeared in the Large Magellanic Cloud for the first time in 400 years. In addition, "Ginga" has discovered new space X-ray sources and gamma-ray bursters. Through these activities, "Ginga" has attracted much attention and expectation from astronomers world-wide.

On board "Ginga" are instruments which Japan developed in co-operation with the United Kingdom and the United States. This has contributed much to the promotion of international collaboration in the field of space science.

(d) Aurora observation satellite

The aurora observation satellite "Akebono" was launched in February 1989. It observes the acceleration mechanism of particles and aurora phenomena in the geomagnetic region at high resolutions. The orbit is highly elliptic with a perigee of about 270 km and a 10,000-km apogee. On board EXOS-D is the Suprathermal Ion Spectrometer developed by the National Research Council of Canada. The Prince Albert Tracking Station in Canada is carrying out the telemetry operation of the satellite.

2. Future activities

(a) GMS-5

In 1994, GMS-5 is scheduled to be launched as the successor to GMS-4, to ensure continuous support to the meteorological services in Asia and Oceania. The satellite will have an infrared water vapour channel to detect the condition of the mid-atmosphere and two infrared window channels which are expected to provide more precise detection of sea surface temperatures. It is also planned to equip GMS-5 with a search-and-rescue transponder to relay distress signals for demonstration experiments.

(b) Marine Observation Satellite-1b (MOS-1b)

Development of MOS-1b with the same specifications as those of MOS-1 is being advanced for launch in early 1990 as a successor to MOS-1.

(c) Earth Resources Satellite-1 (ERS-1)

ERS-1 is an Earth observation satellite scheduled to be launched in 1992, and its orbit will be sun-synchronous at an altitude of approximately 570 km. The main objective of the satellite is to explore resources. In addition, it will conduct a variety of tasks, such as monitoring polar/sea ice, making national land surveys and agriculture/forestry/fishery-related observations. To accomplish such missions, the satellite will be equipped with synthetic aperture radar and an optical sensor.

(d) Advanced Earth Observation Satellite (ADEOS)

In an effort to contribute to the solution of the global climatic change issues, it is planned for ADEOS to be launched around 1995 to conduct various monitoring activities from space, such as monitoring of sea surface colour and temperature and distribution of ozone and carbon dioxide. ADEOS will carry eight instruments, including three instruments supplied by foreign suppliers in response to Japan's announcement of opportunity.

(e) First Material Processing Test (FMPT)

The FMPT programme is the experiment scheme in which the first Japanese payload specialist will board the United States Space Shuttle and conduct new material processing tests in space. The Space Shuttle mission for FMPT is currently scheduled for 1991.

(f) International Microgravity Laboratory-1 (IML-1)

Japan will take part in the United States (IML-1) programme, which will be an international microgravity experiment scheme using a space shuttle for the accumulation of space environment utilization technology scheduled to be launched in 1990. Participation in the IML-2 programme is also under study.

(g) Space Station

The permanently manned Space Station will be constructed in a low Earth orbit through co-operation between Japan, the United States, Europe and Canada. In September 1988, Japan, together with the United States, member countries of ESA and Canada, signed the Space Station Co-operation Agreement. In September 1989 Japan deposited its instrument of acceptance. Under the agreement, Japan has been undertaking the development of the Japanese Experiment Module (JEM), which will be launched by the Space Shuttle in Japanese fiscal year 1997. Material processing experiments, life science experiments, etc., will be performed in JEM.

(h) Thirteenth Scientific Satellite (MUSES-A)

MUSES-A is scheduled to be launched in 1990. The satellite is intended to carry out lunar swingby operations as well as precise orbit determination, control and high-efficiency transmission required for future interplanetary missions.

On board the satellite will be a dust counter developed by the Munich Institute of Technology in the Federal Republic of Germany. In addition, MUSES-A will have the support of the Jet Propulsion Laboratory of NASA in its mission operation phase.

(i) Space Experiment by Particle Accelerators (SEPAC)

SEPAC will be launched by the Space Shuttle in 1990. This will be the second launch of SEPAC. It aims to clarify the mechanism of aurora emission, the dynamics

of charged particles and the excitation of electromagnetic waves in geomagnetic plasma by radiating plasma and electron beams.

(j) Fourteenth Scientific Satellite (SOLAR-A)

SOLAR-A is scheduled to be launched in 1991. The objective of the satellite is to obtain high-resolution images of solar flares during the next solar maximum period. Its designed orbit is quasi-circular with an altitude of 550-600 km.

On board the satellite will be a soft X-ray imager, jointly developed by the Institute of Space and Astronautical Science of Japan (ISAS) and the Lockheed Palo Alto Institute of the United States, and an X-ray high-resolution spectrometer, also jointly developed by ISAS, the Mallard Space Science Institute of London University and the Rutherford-Appleton Laboratory.

(k) Earth Magnetosphere Observation Satellite (GEOTAIL)

GEOTAIL is scheduled to be launched in 1992. It is essentially a collaborative mission between ISAS and NASA. ISAS is in charge of the development of the spacecraft and NASA is responsible for the launch of the spacecraft by the Delta II rocket. The satellite will investigate the structure and dynamics in the long-extending magnetotail on the dark side of the Earth.

(l) X-ray Astronomical Satellite (ASTRO-D)

ASTRO-D is scheduled to be launched in 1993. Its main objective is the X-ray imaging of a variety of celestial bodies as well as the precise observation of the spectrum in the X-ray band. The orbit will be quasi-circular with an altitude of 500-600 km.

On board the satellite will be an X-ray reflector and X-ray imager to be developed by ISAS, the NASA Goddard Space Flight Center and the Massachusetts Institute of Technology.

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INTERNATIONAL CO-OPERATION IN THE PEACEFUL USES OF OUTER SPACE - PROGRAMMES OF MEMBER STATES

Note by the Secretariat

Addendum

The present document contains information provided in replies received from Member States relating to paragraphs 4, 4 (c), 5 and 5 (a) of the recommendations of the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) (A/AC.105/429, annex II) up to 26 February 1990.

UNION OF SOVIET SOCIALIST REPUBLICS

[Original: Russian]

Information on equipment and techniques developed as a result of studies in the field of space biology and medicine (para. 5 (a) of the Working Group's report)

1. The piloted space flights, research on board biological satellites and ground-based experiments modelling the effects of weightlessness conducted in the USSR have provided a large amount of scientific material and enriched fundamental knowledge concerning the nature of the effects of the Earth's gravitational force on various biological objects, including man. These data are of importance to medicine, and particularly to an understanding of the normal and pathological reactions occurring under the effect of gravitational stress. Space medicine has broadened our ideas about the mechanisms of man's spacial orientation, the role, structure and functions of the vestibular apparatus, postural motor reflexes, biomechanics, the motor apparatus of the body, the cardiovascular and nervous

system, the function of analysers and the physiological mechanisms for the maintenance of homeostasis.

Soviet space science and medicine are currently working intensively on a number of topical subjects which provide a new factual basis for and theoretical understanding of such medico-physiological categories as adaptation, homeostasis, standard reactions and individual human reactions to normal and pathological stimuli. Benefits for clinical medicine were derived from the study of the effects of weightlessness conducted by modelling these effects under terrestrial conditions by hypokinesis (bed rest). To date, a large number of experimental studies have been conducted under conditions of hypokinesis, including studies involving the prolonged confinement of a healthy human being to bed rest for periods of up to a year. Extensive material has been obtained on the state and functions of all systems of the human organism under these conditions, and various methods and means of correcting the changes that occur, as well as comprehensive rehabilitation measures, have been approved.

2. The lead institution in the field of space medicine and biology in the USSR is the Institute of Medico-Biological Problems of the Ministry of Health of the USSR. The Institute, which possesses a well developed scientific base, is equipped with modern high-quality medico-biological equipment and has a wide range of special test benches, simulators, centrifuges, pressure chambers and facilities for radiobiological research, offers services for the organization, preparation and conduct of tests on man, as well as experiments with animals:

- to study the physiological effects of actual weightlessness on board spacecraft;

- to study the impact of space-flight and other extreme factors on animals and the human organism in simulations and experiments under real conditions.

3. If people are to spend a long time living and working in the artificial living environment of space facilities, keeping them healthy and fit for work requires intensive study of the problems of human ecology. Detailed work on the development of life-support facilities for spacecraft has led to the implementation of new scientific and technical solutions which can be used to ensure an appropriate living and working environment for man not only in space, but also in the working conditions of modern industry.

4. An electrochemical water-quality analyser can be used to measure the purity of drinking, natural and waste water for health and epidemiological monitoring purposes. The instrument is used to determine micro-quantities of heavy metals and organic impurities in liquid media. Its working principle is based on adsorption of these substances on a platinum micro electrode. Its sensitivity for determination of heavy metal cation concentrations is $5 \times 10^{-4} - 10^{-3}$ mg/l, and for organic impurities $10^{-1} - 10^{-3}$ mg/l. The time required for the analysis is 5-10 minutes. The water samples need no preliminary treatment. This instrument can be used to analyse water both in field conditions and in automatic monitoring systems.

5. The "Ikar" instrument has been developed for automatic determination of the quantitative atmospheric content of harmful organic impurities - acetone, benzene, butanol, xylene, toluene, formaldehyde - in all, around 40 substances. Its operating principle is based on chromatography with two-stage concentration of the sample. The instrument's mass is not more than 64 kg, and the time required for a complete analysis is around 53 minutes. The detection threshold for impurities is 2-3 orders lower than that of other chromatographs manufactured in the USSR and abroad.

Over the years that have elapsed since the beginning of piloted flights, there has been a constant expansion and improvement in the range of medical equipment required to study various aspects of man's activity in space. Many of these developments are today acknowledged as of interest for use in health care.

6. The Ekhovazoskop (EVS-02) instrument developed in the USSR permits simultaneous recording on two independent channels of the state of the biostructure being studied, with visual depiction of the data obtained on a cathode-ray screen and via a digital display. This instrument can be used to determine the phase-amplitude and time characteristics of oscilatory processes and of the lines of division between structural elements of organs and tissues. It affords the possibility for the monitoring and observation over time of the indices of intracranial blood and fluid dynamics, the haemodynamics of various organs and haemokinesis in the main blood vessels, and can be of use in neurosurgical facilities and in experimental medicine. The fact that the instrument is portable means that it can be used not only in fixed installations, but also in ambulances.

7. The AVIMP instrument, which applies an impulse magnetic field to the human body, may be used for physiotherapeutic treatment of persons needing muscle stimulation, and also in the case of inflammation, edema, osteochondrosis, and the like. This instrument applies an impulse magnetic field to muscle and bone tissue and at the same time creates a vortical electric field. It remains effective when operated through clothing, gauze, plaster and other non-metallic coverings with a thickness of up to 10 mm. The instrument weighs no more than 24 kg. It has advantages over existing instruments of that kind by its wider range, greater depth and effectiveness of operation, as well as by putting less pressure on surface tissue. Use of the instrument in clinical practice makes it possible to reduce the treatment period by one third.

8. Technical advances have been made in designing circuits for purification of liquid media which provide a new method of preparing haemosorbents that does not traumatize the blood. The process consists in applying a special coating to the haemosorbent which makes it fully compatible with the blood. Unlike existing methods, this one is simpler, cheaper and does not change the sorption capacity of the haemosorbent, since the coating does not impede the access of toxic substances to the surface of the sorbent. A sorbent prepared by this method does not destroy the formed elements of the blood, does not give off particles, does not deoxygenate the blood and may be sterilized by any means, since the coating withstands heat up to 250° C without any change in properties.

9. A transportable artificial kidney has been developed and approved for persons suffering from endogenous or exogenous poisoning or from diseases of the kidneys or liver, and for liver-transplant operations. The circuits for purification of the dialysate from the electrochemical kidney incorporate an electrolyser at the anode of which electrochemical oxidization of organic toxins takes place. This prevents leaching of non-organic substances from the body, making it possible to reduce the volume of the dialytic solution from 300 litres to 1.5 litres and lengthen the intervals between dialyses. This artificial kidney can be used in both clinics and ambulances. It could form the basis for developing a portable artificial kidney.

10. A portable dental kit has been developed for space flight. It comprises a miniature drill, a set of stomatological instruments and drills, upper and lower forceps for tooth extraction, dental-filling material and medicaments for pain-killing and healing. This kit can be used for extracting teeth and for healing caries, pulpitis and stomatological diseases. The kit does not exceed 4 kg in weight. It may be used for administering first aid in the field during expeditions, and for preventive-care examinations of the population in isolated areas.

11. The Soviet Union, which has acquired considerable experience in space biology and medicine, is successfully developing international co-operation in studying the effects of weightlessness and other space-flight factors on animals and the human organism. A scientific research programme is being conducted jointly by specialists from countries of the Socialist community and scientists from the United States, Canada, India and countries of the European Space Agency. Through the joint efforts of research workers of various countries, it has been possible to combine scientific potential and develop new equipment for space research which can be used successfully in both actual practice and scientific experiments. To cite an example, the Pnevmotest apparatus has been developed jointly with specialists from the German Democratic Republic for research into the biomechanics of human respiration. This apparatus makes it possible to measure the total flow of air during inhalation and exhalation ranging from 0.15 l/sec to 20 l/sec with an error not exceeding 5 per cent of the measured magnitude. The built-in microprocessor makes it possible to identify and calculate over 30 respiratory indicators, such as respiratory volume, the vital capacity of the lungs, the inhalatory and exhalatory reserve volume, the temperature of exhaled air, and the distensibility of the entire respiratory system and its components. In view of its portability and higher reliability, the apparatus may be widely used in scientific research for studying the effects of various adverse factors on the human respiratory system. A Korteks-2 portable apparatus has been developed by Soviet and Cuban specialists for studying the functioning of the central nervous system and evaluating human psychophysiological functions. This apparatus enables an electro-oculogram, an electrocardiogram and an electroencephalogram to be taken using two electrode points. It can be used in the field of work hygiene and vocational selection for assessing visual perception and information processing by the human operator. It enables criteria to be identified for assessing the quality of the operator's work during periods of study, active work and fatigue. Processing of the information received is carried out with the aid of computers.

12. Foreign firms and organizations interested in co-operating with the Soviet Union in space biology and medicine may be provided on a commercial basis with detailed scientific and technical information on instruments, apparatus and equipment developed by Soviet space medicine for space flight.

Inquiries may be sent to the Institute for Medico-Biological Problems of the Ministry of Health of the USSR at the following address: 123007, Moscow, Khoroshevsky Shosse 76-A. Telephone: 195-68-71; telex: 411048 VUAL SU.

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Note by the Secretariat

Addendum

The present document contains information provided in replies received from Member States relating to paragraphs 4 (c) and 5 (a) of the recommendations of the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) (A/AC.105/429, annex II), up to 6 March 1990.

UNION OF SOVIET SOCIALIST REPUBLICS

[Original: Russian]

Information on the areas of space activities that may be a subject of a wider international co-operation (para. 4 (c) of the Working Group's Report)

The following information is being provided to supplement the information submitted to the Scientific and Technical Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space at its twenty-fifth session in 1988 (document A/AC.105/407) concerning those kinds of space activity which could be the subject of broader international co-operation.

1. The endorsement by the United Nations General Assembly of the initiative of international non-governmental scientific organizations to designate 1992 as International Space Year opens up unique prospects for combining the efforts of all

States in the peaceful conquest of space. The Soviet Union stands ready to co-operate with other countries with a view to achieving major results in the field of space science, technology and education as part of preparations for and the celebration of Space Year, and to take a very active part in the related events. At the practical level, the activities being planned in the USSR in connection with International Space Year include an international meeting of young cosmonauts, young scientists and experts working on questions relating to the peaceful conquest of space, an international conference entitled "Space and mankind's global problems on the threshold of the twenty-first century", international seminars and symposia on different fields of near and deep space research and international medical and biological experiments in space. The preparation of photographic imagery of the Earth from Soviet spacecraft, for transmission free of charge to a number of developing countries (two or three countries in each region) in 1992, is also under consideration, as is the mounting of exhibits at the United Nations on achievements in the area of research into and the use of outer space for peaceful purposes.

2. Great possibilities exist for international co-operation in the use of space equipment to avoid ecological disasters. The Soviet Union attaches considerable importance to joint action by all States in this sphere and is therefore proposing an international space laboratory or manned orbital station to monitor natural conditions. As a first step towards putting this proposal into effect, there are plans to use the specialized module in Priroda, which will be launched and docked with the Mir orbital station in 1992. The Soviet Union has invited all interested States to take part in experiments with the module and install the appropriate scientific apparatus in it.

3. The Soviet Union is in favour of continuing international co-operation in the area of joint manned flights. In 1988-1989 alone, cosmonauts from Bulgaria, Afghanistan and France made flights on Soviet spaceships and the Mir orbital station (to add 1 to the 12 joint expeditions undertaken earlier). At the present time, preparations for Soviet-British, Soviet-Austrian and Soviet-Japanese space flights are in full swing. It is important to emphasize that these flights will be carried out on a commercial basis. Furthermore, a flight by a cosmonaut from the Federal Republic of Germany is being negotiated and an agreement has been signed with France for the conduct of a long-term programme of joint manned flights. The first flight under this programme is scheduled for 1991, and it too will be conducted on a commercial basis.

4. The Soviet Union believes that real possibilities exist for broadening space co-operation among States in the acquisition, processing, storage and dissemination of multi-band space photographic information on the Earth's natural resources, and in pure and applied research into ways of improving remote-sensing methods and technology and data processing and interpretation. Such co-operation could be developed along the following basic lines:

- development of methods, algorithms and programmes for automatic (digital) space-imagery processing for cartographic and other purposes;

- experimental testing of equipment for analysing and processing multi-band photographic data from space;

- upgrading the content of and the technology for producing thematic maps from space imagery.

The Soviet Union can on mutually beneficial terms provide interested countries with photographic material derived from space imagery of their territory, and offer training in the processing and interpretation of space photography and photographic information on natural resources.

5. In the context of its extensive co-operation, the Soviet Union is preparing a number of large-scale space projects for fundamental research into outer space and the solar system. These include the Spektr-Roentgen-Gamma project for studying x-ray and gamma-ray emissions (1993), the Regata project for studying solar-terrestrial interactions (1993-1994), the Radioastron project for studying radio emissions (1994), the Spektr-UV project for studying ultraviolet radiation (1995-1996), the Mars-94 project for studying the planet Mars (1994) and the Aelita project for studying infrared radiation (1997-1998).

Plans are also being made for conducting scientific experiments during the period 1993-1995 for study of the Earth's atmosphere and surface from on board specialized scientific modules forming part of the Mir orbital complex, as well as from the Meteor-3 satellite and the Almaz unmanned orbital station. In the longer term it is planned to carry out a project for setting up a manned lunar base; the Soviet side is ready to join with other States in elaborating and carrying out this project.

6. A large-scale, long-term programme which would benefit all countries is the international programme for a manned expedition to Mars. There is already a sound basis for this idea: scientists have accumulated considerable experience of prolonged manned space flight, mastered the assembly of large-scale structures in outer space and developed powerful carrier rockets; and there is much scientific and technological potential. International co-operation in the conquest of Mars in the interests of all humanity would logically lead to much more openness in national space programmes and scientific and research laboratories, thereby making a real contribution to confidence-building and stability.

7. Another important step could be the development of broader co-operation among States in such international fields as the practical application of space technology in communications, navigation and remote sensing of the Earth. In the distant future, this could include the development of satellite systems for observing the planets, forecasting and notification of extreme situations and natural disasters (earthquakes, avalanches, mud-flows, floods and the like), and the further improvement and development of the Cospas-Sarsat international search-and-rescue satellite system. There is now a pressing need to co-ordinate the efforts of States in the development of global satellite systems of educational television broadcasting (using high-definition television) and international systems for the exchange of medical information via satellite.

8. An important aspect of the development of co-operation in outer space is the Soviet proposal to launch spacecraft for other countries and international organizations under mutually acceptable conditions. It should be noted that mutually advantageous co-operation in this field is being hindered by the discriminatory restrictions on the export of technology to socialist countries. The Soviet side urges that an objective and impartial appraisal of the possibilities of co-operation among States in the launching of spacecraft should be carried out on the basis of economic expediency and advantage, and that those restrictions should be lifted.

9. In recent years the Soviet Union has been actively developing bilateral co-operation in the exploration and peaceful uses of outer space. This is borne out, among other things, by the signature during the period 1987-1989 of intergovernmental agreements with Australia, Austria, Brazil, Canada, Finland, France, India, Italy and the United States, among others. These agreements provide for joint projects and experiments in space astronomy, astrophysics, solar-terrestrial physics, space geodesy, remote sensing of the Earth and microgravity, joint development of equipment, launching of spacecraft, experiments in orbit, and the like.

10. Practical international co-operation in the above fields could assist in developing and promoting fruitful and mutually advantageous collaboration among States in space, thereby laying a firm foundation for peaceful work in outer space and helping to ensure a durable peace on Earth.